

WHAT IS CLAIMED IS:

1. A blown-film process for making a fiber-reinforced film, comprising:
providing at least one thermoplastic resin;
melting the at least one thermoplastic resin;
5 extruding the at least one thermoplastic resin through an extension die to form
a film bubble;
introducing a plurality of fibers inside of the film bubble;
distributing the fibers inside of the film bubble; and
collapsing the film bubble after introducing the plurality of fibers so as to form
10 a fiber-reinforced film, the fiber-reinforced film having a first thermoplastic layer, a
second thermoplastic layer, and a plurality of fibers dispersed therebetween.
2. The process of claim 1, wherein the at least one thermoplastic resin is selected
from the group consisting of polyolefins, polyesters, nylons, alkenyl aromatic
15 polymers, polyvinyl chlorides, and combinations thereof.
3. The process of claim 1, wherein the at least one thermoplastic resin is a blend
of thermoplastic resins.
- 20 4. The process of claim 3, wherein the at least one thermoplastic resin comprises
a blend of a polyolefin and a cyclic olefin copolymer.
5. The process of claim 1, wherein the total thickness of the first and second
thermoplastic layers is from about 0.2 mil to about 2.0 mils.
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6. The process of claim 5, wherein the total thickness of the first and second
thermoplastic layers is from about 0.4 mil to about 1.0 mil.
7. The process of claim 1, wherein the thickness of the fiber-reinforced film is
30 from about 0.8 mil to about 2.0 mils.
8. The process of claim 7, wherein the thickness of the fiber-reinforced film is
from about 1.0 mil to about 1.6 mils.

9. The process of claim 1, wherein the extension die is an annular die.

10. The process of claim 1, wherein the plurality of fibers is electrically charged to assist in improving the affinity of the plurality of fibers to the film bubble.

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11. The process of claim 1, wherein the plurality of fibers contacts an inner surface of the film bubble.

12. The process of claim 1, wherein the plurality of fibers adheres to an inner
10 surface of the film bubble.

13. The process of claim 1, wherein the extruding is performed using at least one horizontal extruder.

14. The process of claim 1, wherein the extruding is performed using at least one
15 vertical extruder.

15. The process of claim 1, wherein the plurality of fibers is a thermoplastic material.

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16. The process of claim 15, wherein the plurality of fibers is formed from at least two thermoplastic materials.

17. The process of claim 16, wherein the plurality of fibers is formed from a
25 polyolefin and a cyclic olefin copolymer.

18. The process of claim 1, wherein the plurality of fibers comprises at least two layers.

19. The process of claim 1, wherein the plurality of fibers comprises an additive
30 that assists in adhering the plurality of fibers to an inner surface of the film bubble.

20. A blown-film process for making a fiber-reinforced bag, comprising:

providing at least one thermoplastic resin;
melting the at least one thermoplastic resin;
extruding the at least one thermoplastic resin through an extension die to form
a film bubble;

5 introducing a plurality of fibers inside of the film bubble;
distributing the fibers inside of the film bubble;

collapsing the film bubble after introducing the plurality of fibers so as to form
a fiber-reinforced film, the fiber-reinforced film having a first thermoplastic layer, a
second thermoplastic layer, and a plurality of fibers dispersed therebetween;

10 forming a first and a second body panel from the fiber-reinforced film; and
closing the first and second body panels along two opposing sides and a
bottom to form the fiber-reinforced bag.

21. The process of claim 20, wherein the fiber-reinforced film is folded to form a
15 bottom.

22. The process of claim 20, wherein the fiber-reinforced film is folded to form
one of the opposing sides of the bag.

20 23. The process of claim 20, wherein the first and second body panels are
respectively formed from two distinct portions of fiber-reinforced film.

24. The process of claim 20, wherein the at least one thermoplastic resin is
selected from the group consisting of polyolefins, polyesters, nylons, alkenyl aromatic
25 polymers, polyvinyl chlorides, and combinations thereof.

25. The process of claim 20, wherein the at least one thermoplastic resin is a blend
of thermoplastic resins.

30 26. The process of claim 25, wherein the at least one thermoplastic resin
comprises a blend of a polyolefin and a cyclic olefin copolymer.

27. The process of claim 20, wherein the total thickness of the first and second thermoplastic layers is from about 0.2 mil to about 2.0 mils.

28. The process of claim 27, wherein the total thickness of the first and second thermoplastic layers is from about 0.4 mil to about 1.0 mil.

29. The process of claim 20, wherein the thickness of the fiber-reinforced film is from about 0.8 mil to about 2.0 mils.

30. The process of claim 29, wherein the thickness of the fiber-reinforced film is from about 1.0 mil to about 1.6 mils.

31. The process of claim 20, wherein the extension die is an annular die.

32. The process of claim 20, wherein the plurality of fibers is electrically charged to assist in improving the affinity of the plurality of fibers to the film bubble.

33. The process of claim 20, wherein the plurality of fibers contacts an inner surface of the film bubble.

34. The process of claim 20, wherein the plurality of fibers adheres to an inner surface of the film bubble.

35. The process of claim 20, wherein the extruding is performed using at least one horizontal extruder.

36. The process of claim 20, wherein the extruding is performed using at least one vertical extruder.

37. The process of claim 20, wherein the plurality of fibers is a thermoplastic material.

38. The process of claim 20, wherein the plurality of fibers is formed from at least two thermoplastic materials.

39. The process of claim 38, wherein the plurality of fibers is formed from a
5 polyolefin and a cyclic olefin copolymer.

40. The process of claim 20, wherein the plurality of fibers comprises at least two layers.

10 41. The process of claim 20, wherein the plurality of fibers comprises an additive that assists in adhering the plurality of fibers to an inner surface of the film bubble.

42. A blown-film process for making a fiber-reinforced bag, comprising:
providing at least one thermoplastic resin being selected from the group
15 consisting of polyolefins, polyesters, nylons, alkenyl aromatic polymers, polyvinyl chlorides, and combinations thereof,

melting the at least one thermoplastic resin;

extruding the at least one thermoplastic resin through an extension die to form
a film bubble;

20 introducing a plurality of fibers inside of the film bubble, the plurality of fibers being electrically charged to assist in improving the affinity of the plurality of fibers to the film bubble;

distributing the fibers inside of the film bubble such that the plurality of fibers
contacts an inner surface of the film bubble;

25 collapsing the film bubble after introducing the plurality of fibers so as to form a fiber-reinforced film, the fiber-reinforced film having a first thermoplastic layer, a second thermoplastic layer, and a plurality of fibers dispersed therebetween, the total thickness of the first and second thermoplastic layers being from about 0.4 mil to about 1.0 mil.;

30 forming a first and a second body panel from the fiber-reinforced film; and
closing the first and second body panels along two opposing sides and a bottom to form the bag.

43. A cast-film process for making a fiber-reinforced film, comprising:
providing at least a first thermoplastic resin;
melting the at least first thermoplastic resin;
extruding the at least first thermoplastic resin through a first extension die to
5 form a first thermoplastic film;
providing at least a second thermoplastic resin;
melting the at least second thermoplastic resin;
extruding the at least second thermoplastic resin through a second extension
die to form a second thermoplastic film;
10 transporting the first and second thermoplastic films along respective casting
rollers; and
introducing a plurality of fibers between the first and second thermoplastic
films so as to form a fiber-reinforced film, the fiber-reinforced film having a first
thermoplastic layer, a second thermoplastic layer, and a plurality of fibers dispersed
15 therebetween.
44. The process of claim 43, wherein the plurality of fibers is in a continuous
sheet.
- 20 45. The process of claim 43, wherein the first thermoplastic resin and the second
thermoplastic resin are the same.
46. The process of claim 43, wherein the at least one thermoplastic resin is
selected from the group consisting of polyolefins, polyesters, nylons, alkenyl aromatic
25 polymers, polyvinyl chlorides, and combinations thereof.
47. The process of claim 43, wherein the plurality of fibers is a thermoplastic
material.
- 30 48. A cast-film process for making a fiber-reinforced film, comprising:
providing at least a first thermoplastic resin;
melting the at least first thermoplastic resin;

extruding the at least first thermoplastic resin through a first extension die to form a first thermoplastic film;

providing at least a second thermoplastic resin;

melting the at least second thermoplastic resin;

5 extruding the at least second thermoplastic resin through a second extension die to form a second thermoplastic film;

transporting the first and second thermoplastic films along respective casting rollers;

10 introducing a plurality of fibers between the first and second thermoplastic films so as to form a fiber-reinforced film, the fiber-reinforced film having a first thermoplastic layer, a second thermoplastic layer, and a plurality of fibers dispersed therebetween;

forming a first and a second body panel from the fiber-reinforced film; and

15 closing the first and second body panels along two opposing sides and a bottom to form the bag.

49. The process of claim 48, wherein the plurality of fibers is in a continuous sheet.

20 50. The process of claim 48, wherein the first thermoplastic resin and the second thermoplastic resin are the same.

51. The process of claim 48, wherein the at least one thermoplastic resin is selected from the group consisting of polyolefins, polyesters, nylons, alkenyl aromatic
25 polymers, polyvinyl chlorides, and combinations thereof.

52. The process of claim 48, wherein the plurality of fibers is a thermoplastic material.

30 53. A fiber-reinforced film comprising at least two layers and a plurality of fibers therebetween, the first layer being made of at least a first thermoplastic resin and the second layer being made of at least a second thermoplastic resin, wherein the film has a MD tear of greater than 250g as measured in accordance with ASTM D 1922, a MD

tensile strength of greater than about 800 as measured in accordance with ASTM D 882, and a puncture resistance of greater than 120g as measured in accordance with ASTM D 1709 and the basis weight of the plurality of fibers is less than about 10 g/m².

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54. The film of claim 53, wherein the basis weight of the plurality of fibers is less than about 5 g/m².

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55. The film of claim 53, wherein the first and second thermoplastic resins are selected from the group consisting of polyolefins, polyesters, nylons, alkenyl aromatic polymers, polyvinyl chlorides, and combinations thereof.

56 The film of claim 53, wherein the first and second thermoplastic resins are a blend of thermoplastic resins.

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57. The film of claim 56, wherein the first and second thermoplastic resins comprise a blend of polyolefin and a cyclic olefin copolymer.

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58. The film of claim 53, wherein the total thickness of the first and second thermoplastic layers is from about 0.2 mil to about 2.0 mils.

59. The film of claim 58, wherein the total thickness of the first and second thermoplastic layers is from about 0.4 mil to about 1.0 mil.

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60. The film of claim 53, wherein the thickness of the fiber-reinforced film is from about 0.8 mil to about 2.0 mils.

61. The film of claim 60, wherein the thickness of the fiber-reinforced film is from about 1.0 mil to about 1.6 mils.

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62. A fiber-reinforced bag comprising first and second opposing body panels that are closed along two opposing sides and a bottom, each of the first and second opposing body panels comprising a fiber-reinforced film, the fiber-reinforced film

comprising at least two layers and a plurality of fibers therebetween, the first layer being made of at least a first thermoplastic resin and the second layer being made of at least a second thermoplastic resin, wherein the film has a MD tear of greater than 250g as measured in accordance with ASTM D 1922, a MD tensile strength of greater than about 800 as measured in accordance with ASTM D 882, and a puncture resistance of greater than 120g as measured in accordance with ASTM D 1709 and the basis weight of the plurality of fibers is less than about 10 g/m².

63. The bag of claim 62, wherein the basis weight of the plurality of fibers is less than about 5 g/m².

64. The bag of claim 62, wherein the first and second thermoplastic resins are selected from the group consisting of polyolefins, polyesters, nylons, alkenyl aromatic polymers, polyvinyl chlorides, and combinations thereof.

65. The bag of claim 62, wherein the first and second thermoplastic resins are a blend of thermoplastic resins.

66. The bag of claim 65, wherein the first and second thermoplastic resins comprise a blend of polyolefin and a cyclic olefin copolymer.

67. The bag of claim 62, wherein the total thickness of the first and second thermoplastic layers is from about 0.2 mil to about 2.0 mils.

68. The bag of claim 67, wherein the total thickness of the first and second thermoplastic layers is from about 0.4 mil to about 1.0 mil.

69. The bag of claim 62, wherein the thickness of the fiber-reinforced film is from about 0.8 mil to about 2.0 mils.

70. The bag of claim 77, wherein the thickness of the fiber-reinforced film is from about 1.0 mil to about 1.6 mils.